CLAIMS

1. A method for providing enhanced utilization of code resource in a cellular systems, preferably a terrestrial cellular CDMA systems, wherein a base station comprises an antenna system which generates several beams, and a Spreading Factor (SF) of the root channelization code sets an upper limit on the maximum bit rate, wherein the Spreading Factor of the root channelization code is selected according to the set of minimum Spreading Factors assumed for the different beams.

2. Method according to claim 1 wherein the root channelization code is the root PDSCH code (PDSCH = Physical Downlink Shared Channel).

3. Method according to claim 1 or 2, wherein in a case where the channels under a same scrambling code, but different beams, share the same root channelization code, a minimum assumed Spreading Factor for beam number m (SF_{min}[m]) is defined according to the following equation:

$$SF_{DSCHroot} = f\left(\{SF_{\min}[m]\}_{m \in SC}\right),$$

where $SF_{DSCHroot}$ is the minimum assumed Spreading Factor of the root channelization code of a down link shared channel (DSCH), $\{SF_{min}[m]\}_{m \in SC}$ is the set of assumed minimum SFs for the beams transmitted under the same scrambling code, where the set SC contains the beam numbers which are transmitted under the same scrambling code.

4. Method according to any one of the preceding claims, wherein $SF_{DSCHroot}$ is calculated according to the equation

$$SF_{DSCHroot} = f\left(\left\{SF_{\min}[m]\right\}_{m\in SC}\right)$$
$$= Min\left\{\left\{SF_{\min}[m]\right\}_{m\in SC}\right\}/Q$$

with $Q=2^n$, where n is a positive integer, i.e. $n\in[0,1,2,3....]$.

5. Method according to claim 4, wherein Q equals or is preferably smaller than, e.g. half, the number of beams sharing the same root PDSCH code, the beam with the minimum assumed SF being allowed to transmit at the maximum allowed bit rate, while the other channels under different beams but same scrambling code can be active at lower bit rates.

6. Method according to claim 3, wherein the function $f()$ is selected in such a manner that simultaneous transmission in all the beams under the same scrambling code is possible with the minimum assumed Spreading Factor.

7. Method according to any one of the preceding claims, wherein packet scheduling for parallel beams is provided in such a manner that not all beams transmit on downlink, e.g. PDSCH, with high or maximum bit rates (low Spreading Factor) simultaneously.

8. Method according to claim 7, wherein packet scheduling in the individual beams is coordinated so that only one of the beams is transmitting with a high bit rate during the same time period, and different time periods, i.e. scheduling slots, are balanced so they require nearly the same amount of code resources.

9. Method according to claim 7 or 8, wherein the packet scheduling is based on quality-of-service (QoS) so that packet are prioritized according to QoS attributes.

10. Method according to any one of the preceding claims, wherein the selection of the Spreading Factor, and/or packet scheduling is being applied to the downlink, preferably the PDSCH (PDSCH = Physical Downlink Shared Channel), or to High Speed Downlink Packet Access (HSDPA).

11. A system for providing enhanced utilization of code resource in a cellular systems, preferably a terrestrial cellular CDMA systems, comprising a base station having an antenna system adapted to generate several beams, wherein a Spreading Factor (SF) of the root channelization code sets an upper limit on the maximum bit rate, comprising a selecting means (1) for selecting the Spreading Factor of the root channelization code according to the set of minimum Spreading Factors assumed for the different beams.

12. System according to claim 11, wherein the root channelization code is the root PDSCH code (PDSCH = Physical Downlink Shared Channel).

13. System according to claim 11 or 12, wherein in a case where the channels under a same scrambling code, but different beams, share the same root channelization code, the selection means is adapted to select a minimum assumed Spreading Factor, a minimum assumed Spreading Factor for beam number m (SF_{min}[m]) being defined according to the following equation:

$$SF_{DSCHroot} = f\left(\{SF_{\min}[m]\}_{m \in SC}\right),$$

where $SF_{DSCHroot}$ is the minimum assumed Spreading Factor of the root channelization code of a down link shared channel (DSCH), $\{SF_{min}[m]\}_{m \in SC}$ is the set of assumed minimum SFs for

the beams transmitted under the same scrambling code, where the set SC contains the beam numbers which are transmitted under the same scrambling code.

14. System according to any one of the preceding system claims, comprising calculating means (1) for calculating $SF_{DSCHroot}$ according to the equation

$$SF_{DSCHroot} = f(\{SF_{\min}[m]\}_{m \in SC}) = Min\{\{SF_{\min}[m]\}_{m \in SC}\}/Q$$

with $Q=2^n$, where n is a positive integer, i.e. $n \in [0,1,2,3....]$.

15. System according to claim 14, wherein Q equals or is preferably smaller than, e.g. half, the number of beams sharing the same root PDSCH code, the beam with the minimum assumed SF being allowed to transmit at the maximum allowed bit rate, while the other channels under different beams but same scrambling code can be active at lower bit rates.

16. System according to claim 13, wherein the function $f()$ is selected in such a manner that simultaneous transmission in all the beams under the same scrambling code is possible with the minimum assumed Spreading Factor.

17. System according to any one of the preceding system claims, comprising a packet scheduler (5) for providing packet scheduling for parallel beams in such a manner that less than all beams, preferably only one beam, are allowed to transmit on the downlink, e.g. PDSCH, with high bit rates (low Spreading Factor) simultaneously.

18. System according to claim 17, wherein the packet scheduler (5) is adapted to coordinate packet scheduling in

the individual beams so that only one of the beams is transmitting with a high bit rate during the same time period, and different time periods, i.e. scheduling slots, are balanced so they require nearly the same amount of code resources.

19. System according to claim 17 or 18, wherein the packet scheduler (5) is adapted to base packet scheduling on quality-of-service (QoS) so that packet are prioritized according to QoS attributes.

20. System according to any one of the preceding system claims, wherein the system is adapted to apply the selection of the Spreading Factor, and/or packet scheduling to the downlink, preferably the PDSCH (PDSCH = Physical Downlink Shared Channel), or to High Speed Downlink Packet Access (HSDPA).

21. Network element to be used in a method or system as defined in any one of the preceding claims, comprising a selecting means (1) for selecting a Spreading Factor of a root channelization code according to a set of minimum Spreading Factors assumed for different beams.

22. Network element as defined in claim 21, comprising a packet scheduler (5) for providing packet scheduling for parallel beams in such a manner that less than all beams, preferably only one beam, are allowed to transmit on the downlink, e.g. PDSCH, with high bit rates (low Spreading Factor) simultaneously.